Scientific Excellence • Resource Protection & Conservation • Benefits for Canadians
Excellence scientifique • Protection et conservation des ressources • Bénéfices aux Canadiens

Sea trials of a galvanic corrosion delayed release mechanism for snow crab traps

M. Gagnon and M. Boudreau

Department of Fisheries and Oceans
Fisheries and Habitat Management Branch
Champlain Harbour Station, P.O. Box 15,500
901, Cap Diamant, Québec City, G1K 7Y7

March 1991

Canadian Technical Report of Fisheries and Aquatic Sciences No 1803

Fisheries and Oceans Pêches et Océans

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1–456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457–714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715–924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

93-02550/

Canadian Technical Report of Fisheries and Aquatic Sciences

No. 1803

March, 1991

SEA TRIALS OF A GALVANIC CORROSION DELAYED RELEASE MECHANISM FOR SNOW CRAB TRAPS

by

M. Gagnon[1] and M. Boudreau

Department of Fisheries and Oceans
Fisheries and Habitat Management Branch
Champlain Harbour Terminal
P.O. Box 15500
901 Cap Diamant
Quebec, Quebec
G1K 7Y7

[1] BIOREX INC., 969 Route de l'Eglise, Suite 250, Sainte-Foy (Quebec) G1V 3V4

Department of Supply and Services Canada 1991

Catalogue Number Fs 97-6/1803 E ISSN 0706-6570

ISBN 0-662-18897-7

Refer to this publication as:

M. Gagnon and M. Boudreau. 1991. SEA TRIALS OF A GALVANIC CORROSION DELAYED RELEASE MECHANISM FOR SNOW CRAB TRAPS. Can. Tech. Rep. Fish. Aquat. Sci. 1803.. E: vi+17 pages

TABLE OF CONTENTS

Page

LIST OF TABLES iv

LIST OF FIGURES v

ABSTRACT/RESUME vi

INTRODUCTION 1

METHODS AND MATERIALS 2

TRAP MODIFICATION 2

SIZES OF GALVANIC MECHANISMS TESTED 2

LOCATION OF THE SEA TRIALS AND OPERATIONS CALENDAR 2

MEASUREMENTS TAKEN 2

RESULTS 3

ASSESSMENT OF THE COSTS OF INSTALLATION AND OPERATION 4

CONCLUSIONS AND RECOMMENDATIONS 4

REFERENCES 5

LIST OF TABLES

Page

Table 1. Characteristics of the three calibers of galvanic releases installed on the traps 6

Table 2. Dates traps were raised, and water temperature and salinity near the bottom at these times 7

Table 3. Increasing percentages of delayed mechanisms released during the sea trials 8

Table 4. Corrosion speed and time to release of the three calibers of galvanic mechanisms in the three positions on the trap 9

Table 5. Numbers of snow crabs in the two experimental traps during the experiment, along with the numbers of doors and horizontal openings released 10

Table 6. Summary evaluation of the costs of installation and operation of the two types of delayed release mechanisms tested in the trials 11

LIST OF FIGURES

Page

Fig. 1. Change in size of the galvanic attachments with increasing corrosion. Attachments prior to immersion in the sea are shown at the top of the figure 12

Fig. 2. Schematic drawing of the two delayed release mechanisms installed on crab traps 13

Fig. 3. Change in cylinder weight of the three calibers of galvanic device as a function of the number of days of immersion 14

Fig. 4. Change in cylinder weight of the AG50 attachment as a function of the number of days of immersion and the position on the trap .. 15

Fig. 5. Change in cylinder weight of the AG75 attachment as a function of the number of days of immersion and the position on the trap .. 16

Fig. 6. Change in cylinder weight of the AG100 attachment as a function of the number of days of immersion and the position on the trap .. 17

RÉSUMÉ

Des attaches métalliques qui se dégradent par corrosion galvanique ont fait l'objet d'essais dans des conditions représentatives de la pêche au crabe des neiges du sud-oeust du golfe du Saint-Laurent afin de vérifier leur fiabilité en tant que déclencheurs de mécanismes d'échappement du crabe dans les casiers perdus en mer. Les résultats montrent que le délai de déclenchement des trois calibres d'attache testés (55, 75 et 115 jours) est précis et prédictible et que leur déclenchement prématuré ou accidentel est très peu probable. L'installation d'une telle attache dans une ouverture découpée dans le côté des casiers à crabe représente un coût supplémentaire d'opération de 1,25 $ à 2,00 $ par casier par année.

ABSTRACT

Galvanic time releases were tested in conditions representative of the southwestern Gulf of St.Lawrence queen crab fishery in order to evaluate their reliability for avoiding ghost fishing by derelict pots. Results show that the time of release of the three calibers tested (55, 75 and 115 days) is accurate and predictable and that premature and accidental release is most unlikely. The operation costs for galvanic time release mecanisms set up in an opening cut into the side wall of crabs pots was evaluated at 1,25 $ to 2,00 $ per pot per year.

INTRODUCTION

Ghost fishing by lost snow crab traps on fishing grounds in the southwestern Gulf of Saint Lawrence is a problem of increasing concern for fishermen and resource managers. Several thousand traps are lost each year on the fishing grounds of the southwestern Gulf (Maillet et al 1987). Most are conical traps with funnel shaped openings on top; crabs entering these traps are practically incapable of leaving. Furthermore, the polypropylene mesh covering the traps can resist 5 consecutive years of immersion before decomposing. Research on other crab species (Breen 1987, High and Worland 1976, Miller 1976) has shown that lost traps may fish continuously for several years, and that they cause significant resource mortality.

To prevent ghost fishing, some jurisdictions (Alaska, Oregon, New Zealand, Washington) require fishermen to equip their traps with a delayed release mechanism to allow the catch to escape in case of trap loss. Three approaches have been used (Blott 1978, Smolowitz 1978):

1) part of the trap is made of a biodegradable or corrosive material (wood, cotton mesh, or untreated metal wire), or it is connected to the frame by biodegradable or corrosive line;

2) the trap has a door held shut by a biodegradable or corrosive attachment;

3) a row of meshes is removed, and the opening produced is closed by weaving in a biodegradable or corrosive thread.

The biodegradability of natural fibres like wool, surgical sutures, jute, cotton, and wood depends upon several factors, including the source of the material and the intensity of biological processes in situ. Also, the speed of corrosion of metal and alloy wires varies considerably with water temperature, dissolved oxygen concentration, and current speed. This corrosion may also be considerably accelerated in the microfissures formed by twisting or bending the wire (Brown 1969). Accurate and precise prediction of release times for these two types of materials is thus not possible, and their small diameter makes them vulnerable to accidental breakage (Blott 1978). Fishermen hesitate to adopt them in light of the major risks of accidental premature release resulting in lost time and income.

Galvanic time release mechanisms have been developed to reduce the above inconveniences. They are composed of an active metal cylinder (the anode) joining together two stable metal eyelets (the cathodes) (Fig. 1). When these two metals are immersed in a conducting electrolyte (salt water), their contact produces accelerated corrosion (galvanic) of the anode while the cathodic corrosion is slowed (Baboian 1986). As escape release mechanisms, these attachments have several advantages over the materials discussed above:

1) the speed of galvanic corrosion is less dependent upon local in situ conditions than the other forms of corrosion; the precision and accuracy of the release should be greater;

2) since the corrosion is faster, the metal subject to galvanic corrosion can be of much greater diameter than with other types of delay. Risks of breakage while hauling are thus considerably reduced. It also becomes very

easy for a fisherman to detect a defective mechanism, since the release time can be easily estimated from the size of the device.

To test the precision and accuracy of galvanic time release mechanisms, experimental sea trials were carried out in the Fall of 1990. This document reports the results of those trials, as well as a summary evaluation of installation and operating costs of galvanic time release mechanisms.

METHODS AND MATERIALS

TRAP MODIFICATION

Three 1.85 m diameter conical snow crab traps were modified for the sea trials. Three 35 x 25 cm openings were cut in the mesh at the base of the trap side (Fig. 2). A metal rod was welded to the trap frame to form one side of each opening. The opening was then closed by a plywood door attached to the base of the trap. This door was held shut by a galvanic release attached by an eyelet to a knot in the mesh higher on the trap side, and by the other eyelet to the top of the door. When the galvanic mechanism is released, the door opens downward into the trap.

Three additional openings were made in each trap by removing five adjacent knots from the netting along the base of the trap (Fig. 2). These openings were closed by weaving two pieces of polypropylene line from each end of the opening, and connecting them in the centre by a galvanic time release mechanism.

SIZES OF GALVANIC MECHANISMS TESTED

Three different calibers of galvanic releases made by International Fishing Devices Inc. of Florida were tested; their characteristics are shown in Table 1. Each size was distributed on each trap as follows:

- one (1) for each trap door;
- one (1) for each horizontal opening;
- three (3) hanging randomly by an eyelet on each trap.

Each trap was an exact replica of the other two, and a total of 15 galvanic releases of each caliber were installed on the three traps.

LOCATION OF THE SEA TRIALS AND OPERATIONS CALENDAR

The three traps were set at sea on October 2, 1990 on commercial snow crab fishing grounds off Gascons, in the middle of Chaleur Bay. The traps were about 3.5 km apart at a depth of about 85 m. They were baited with herring initially, but no additional bait was added subsequently.

The traps were raised seven (7) times at irregular intervals during the Fall of 1990. Table 2 shows the dates the traps were raised and the temperature and salinity recorded near the bottom on these dates. Physico-chemical conditions were stable during the experiment, with water temperatures between 0.5 and 2.0°C and salinity between 31.7 and 32.6.

MEASUREMENTS TAKEN

At each immersion, the maximum cylinder diameter of each galvanic release was measured with a vernier caliper. The number of snow crabs in

each trap was recorded. The crabs were not removed from the traps, but were reimmersed with it. At irregular intervals, the galvanic devices hanging from the traps were removed and weighed in the laboratory, to establish a relationship between diameter (D) and weight (W). The relationships obtained for each size were as follows:

$$W_{AG50}\ (g) = 0.108\ (10^{0.200\ D(mm)})$$
$$n = 5,\ r^2 = 1.00$$
$$W_{AG75}\ (g) = 0.092\ (10^{0.190\ D(mm)})$$
$$n = 10,\ r^2 = 1.00$$
$$W_{AG100}\ (g) = 0.101\ (10^{0.168\ D(mm)})$$
$$n = 15,\ r^2 = 0.96$$

The diameter data were converted to weights using these equations. The 95% confidence interval for the release time (days) for each size was obtained from the 95% prediction limits for the weight of the cylinder on 150 attachments (Sokal and Rohlf 1969), assuming that release occurs when the weight drops to 0.

RESULTS

One of the three experimental traps was lost between the initial immersion and the next visit. Results are reported on the other two traps combined.

Table 3 shows the increasing percentages of delayed mechanisms which had released at each sea visit. The AG50 caliber started to release between the 43rd and 53rd days of immersion, and had all released by the 60th immersion day. The AG75 caliber started releasing between the 65th and 77th day of immersion, and had not all released by the end of the experiment after 82 days. As expected, none of the AG100 caliber had released by the end of the experiment.

The examination of specimens returned to land (Fig. 1) shows the shape of the cylinder changes as expected during the corrosion process, and release (the separation of the two eyelets) cannot occur until the cylinder is practically 100% corroded. The few devices observed with about 1.0 g of anodic metal remaining between the two eyelets had not released. In the laboratory, a device with as little as 1 g of anodic metal resisted a force of 15 kg applied perpendicular to the axis of attachment.

The relationship obtained between the weight of the anodic metal cylinder and the number of days immersion for the three sizes was linear (Fig. 3). The regression equations obtained were:

$$W_{AG50}\ (g) = 14.51 - 0.266^{**}T\ (days)$$
$$r^2 = 0.90$$
$$W_{AG75}\ (g) = 21.11 - 0.283^{**}T\ (days)$$
$$r^2 = 0.90$$
$$W_{AG100}\ (g) = 32.51 - 0.284^{**}T\ (days)$$
$$r^2 = 0.85$$

where ** signifies a significant regression coefficient ($P<0.01$).

These results show a constant speed of corrosion of the device throughout the trials. Regression coefficients were also not significantly different ($P>0.05$) between calibers, indicating that they had the same corrosion speed (g/day).

The ordinates at the origin of the regression lines in Figure 3 are lower than the initial weight measured (Table 1). This suggests that the speed of corrosion is higher during the first few days of immersion, stabilizing subsequently at a lower rate.

AG50 devices will release after 55 days of immersion, on average.

Prediction limits could not be calculated for this size due to the small number of degrees of freedom. AG75 devices will release after an average of 75 days, with 95% releasing between 71 and 78 days at sea. AG100 devices will release after an average of 115 days, with 95% releasing between 109 and 121 days at sea.

Figures 4, 5 and 6 show that much of the variability between specimens of the same size is attributable to their position on the trap. The average release time for galvanic mechanisms on the doors was 10 - 20% lower than for those on the horizontal openings, whereas randomly hanging devices gave intermediate results (Table 4). The corrosion speed of the door attachments was higher because they were closer to the metal frame of the trap than those on the horizontal openings. Since galvanic corrosion can occur in seawater when the anodic and cathodic metals are several metres apart, the anodic cylinder may react to the cathodic trap frame.

The opening of the doors allowed the crabs to escape from the traps (Table 5). The experimental design did not allow a test of the escape efficiency of the horizontal openings at the base of the trap, since these did not open until several days after the doors.

ASSESSMENT OF THE COSTS OF INSTALLATION AND OPERATION

Table 6 presents a summary evaluation of the costs for installation and operation of time release escape mechanisms on snow crab traps, using the two methods tested in the trials. Costs would not differ significantly for different sizes of traps, since the design of the openings does not depend upon trap size.

The cost of a door installation is about 8 times higher than that of a horizontal opening. The door needs about double the annual maintenance cost, due to the higher cost of repairs.

The initial investment for a fishing unit with 150 traps would be about $2,200. for door installation or $260. for horizontal openings. The annual operating cost would be $380. - $490. for traps with doors or $185. - $290. for traps with horizontal openings.

CONCLUSIONS AND RECOMMENDATIONS

The galvanic devices performed on the fishing grounds just as the manufacturer had predicted. If care is taken to place them in the same position relative to the metal frame of the crab trap, the release time on snow crab fishing grounds will be very accurate and precise. Physico-chemical conditions on the fishing grounds of the southwestern Gulf vary little spatially and temporally (Petrie 1990).

The installed doors are subject to significant water pressure during hauling, which may place stress on the release device. This does not occur with a horizontal opening. Although the galvanic device can resist a strong force until a few days before its release, its installation on a door, as in this experiment, increases the risk of premature accidental release. For this reason, and because the cost of installing a door on a trap is much higher than that of a horizontal opening, we recommend the installation of galvanic releases on lines woven into openings created by

removing knots from the webbing. If the knots are removed so that the opening has the shape of a door opening downward, the crabs' escape could be ensured.

Although the results of this experiment are very conclusive, it is possible that some factors which might affect the performance of the galvanic releases during a normal fishing season might not have been operative during our trials. Hence, we recommend that trials with one or two commercial fishing units be conducted during the entire crab fishing season in 1991.

REFERENCES

Baboian, A.L., 1986. Galvanic corrosion, p. 880-881. *In* Encyclopedia of materials science and engineering. M.B. Bever [ed.], Pergamon Press, MIT Press, Cambridge, Mass.

Blott, A.J., 1978. A preliminary study of timed release mecanisms for lobster traps. Mar. Fish. Rev. 40: 44-49.

Breen, P.A., 1987. Mortality of dungeness crabs caused by lost traps in the Fraser river Estuary, British Columbia. North-Am. J. Fish. Manag. 7: 429-435.

Brown, B.F., 1969. Corrosion behavior, p: 7-26 à 7-30. In J.J. Myers [ed.]. Handbook of ocean and underwater engineering. McGraw-Hill, N.Y.

High, W.L. et D.D. Worland, 1979. Escape of king crab from direlict pots. NOA Adm., Tech. Rep. MMFS SSRF-734.

Mailet, P., Y. Chiasson et M. Moriyasu, 1987. A review of catch fishing effort and biological trends for the 1987 southwestern Gulf of St.Lawrence snow crab fishery. CAFSAC Res. Doc. 88/32.

Miller, R.J., 1977. Resource underutilization in a spider crab industry. Fisheries 2: 9-12.

Petrie, B., 1990. Monthly mean temperature, salinity and sigma-t for the Gulf of St.Lawrence. Can. Tech. Rep. Hydrogr. Ocean Sci. 126: iv + 137 pp.

Smolowitz, R.J., 1978. Trap design and ghost fishing: an overview. Mar. Fish. Rev. 40: 2-8.

Sokal, R.R. et F.J. Rohlf, 1969. Biometry. W.H. Freeman and Co., San Francisco, 776 p.

Table 1. Characteristics of the three calibers of galvanic releases installed on the traps.

	CALIBER		
	AG50	AG75	AG100
Number of days of immersion intended before release.	50	75	100
Cylinder diameter (mm)	22.3	25.4	29.9
Cylinder length (mm)	28.0	28.0	28.0
Total weight of the device (g)	25.3	31.8	41.3
Weight of the cylinder (g)	17.3	23.8	33.3

Table 2. Dates traps were raised, water temperature and salinity near the bottom at these times.

DATE	NUMBER OF DAYS IMMERSION	TEMPERATURE (°C)	SALINITY (g/kg)
02/10/90	0 (immersion)	1.0	32.6
22/10/90	20	0.5	32.6
14/11/90	43	2.0	32.2
24/11/90	53	2.0	—
01/12/90	60	2.0	32.4
08/12/90	67	2.0	32.2
18/12/90	77	2.0	—
23/12/90	82	1.0	31.7

Table 3. Increasing percentages of delayed mechanisms released during the sea trials.

DATE	NUMBER OF DAYS IMMERSION	% RELEASED (number of devices examined) AG50	AG75	AG100
22/10/90	20	0.0 (10)	0.0 (9)	0.0 (11)
14/11/90	43	0.0 (10)	0.0 (9)	0.0 (11)
24/11/90	53	44.4 (9)	0.0 (8)	0.0 (10)
01/12/90	60	100.0 (9)	0.0 (8)	0.0 (10)
08/12/90	67	—	0.0 (7)	0.0 (9)
18/12/90	77	—	57.1 (7)	0.0 (9)
23/12/90	82	—	83.3 (6)	0.0 (8)

Table 4. Corrosion speed and time to release of the three calibers of galvanic mechanisms in the three positions on the trap

CALIBER	POSITION	CORROSION SPEED[1] (g/day) regression coefficient	AVERAGE TIME TO RELEASE (days)
AG50	Door	0.29**	50
	Hanging	0.25**	55
	Horizontal opening	0.28**	59
AG75	Door	0.31**	69
	Hanging	0.29**	77
	Horizontal opening	0.25**	78
AG100	Door	0.33**	100
	Hanging	0.29**	112
	Horizontal opening	0.26**	128

[1] Based on the regression lines in Figures 4,5 and 6

** Significant regression ($P<0.01$)

Table 5. Numbers of snow crabs in the two experimental traps during the experiment, along with the numbers of doors and horizontal openings released.

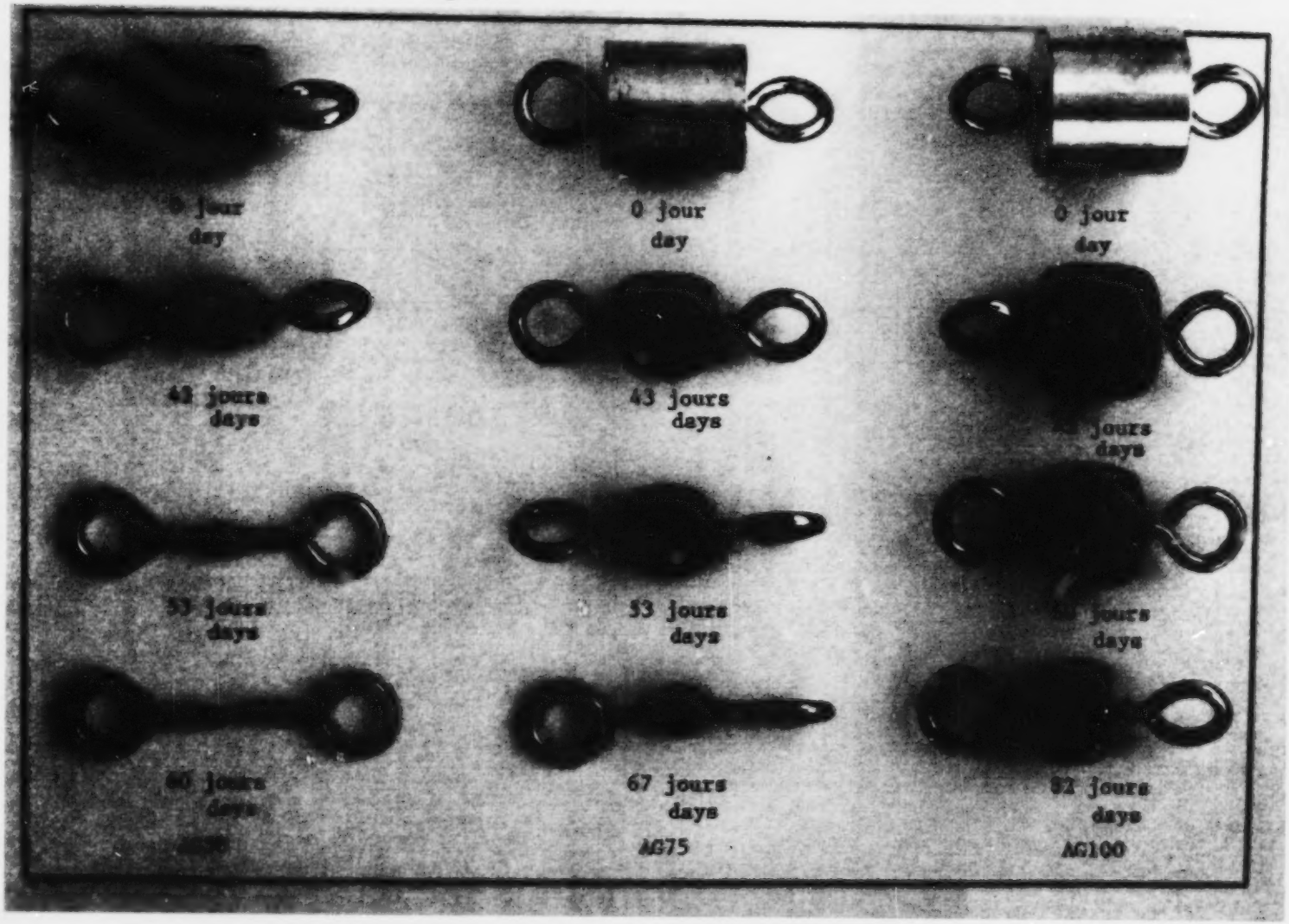
Date	No. of days immersion	TRAP 1			TRAP 2			No. of
		No. of crabs in the trap	No. of doors open	No. of doors horizontals open	No. of in the trap	No. of crabs open	No. of doors horizontals open	
22/10/90	20	7	0	0	50	0	0	
14/11/90	43	8	0	0	2	1*	0	
24/11/90	53	2	1	0	3	1	0	
01/12/90	60	1	1	1	3	1	1	
08/12/90	67	0	1	1	0	1	1	
18/12/90	77	0	2	1	0	2	1	
23/12/90	82	0	2	1	0	2	2	

* The door was open because the delayed mechanism had been improperly closed, and not due to its release.

Table 6. Summary evaluation of the costs of installation and operation of the two types of delayed release mechanisms tested in the trials.

	COST PER TRAP ($)
INSTALLATION COST FOR ONE DOOR	
Labour 0.45 person-hr. @ $10./pers.-hr.	4.50
Metal bar and welding	9.00
Plywood	1.10
Polypropylene line	0.05
Total	14.65
ANNUAL OPERATING COST FOR ONE DOOR	
Repair and replacement of the door (10% of installation cost)	1.50
Galvanic device (AG50 / AG75 / AG100)	1.05 / 1.40 / 1.75
Total	2.55 / 2.90 / 3.25
INSTALLATION COST FOR A HORIZONTAL OPENING	
Labour 0.17 person-hr. @ $10./pers.-hr.	1.70
Polypropylene line	0.05
Total	1.75
ANNUAL OPERATING COST FOR A HORIZONTAL OPENING	
Repair and replacement (10% of installation cost)	0.18
Galvanic device (AG50 / AG75 / AG100)	1.05 / 1.40 / 1.75
Total	1.23 / 1.58 / 1.93

Fig. 1. Evolution du gabarit des attaches galvaniques en fonction du degré de corrosion. Les attaches avant l'immersion en mer sont présentées dans le haut de la figure.



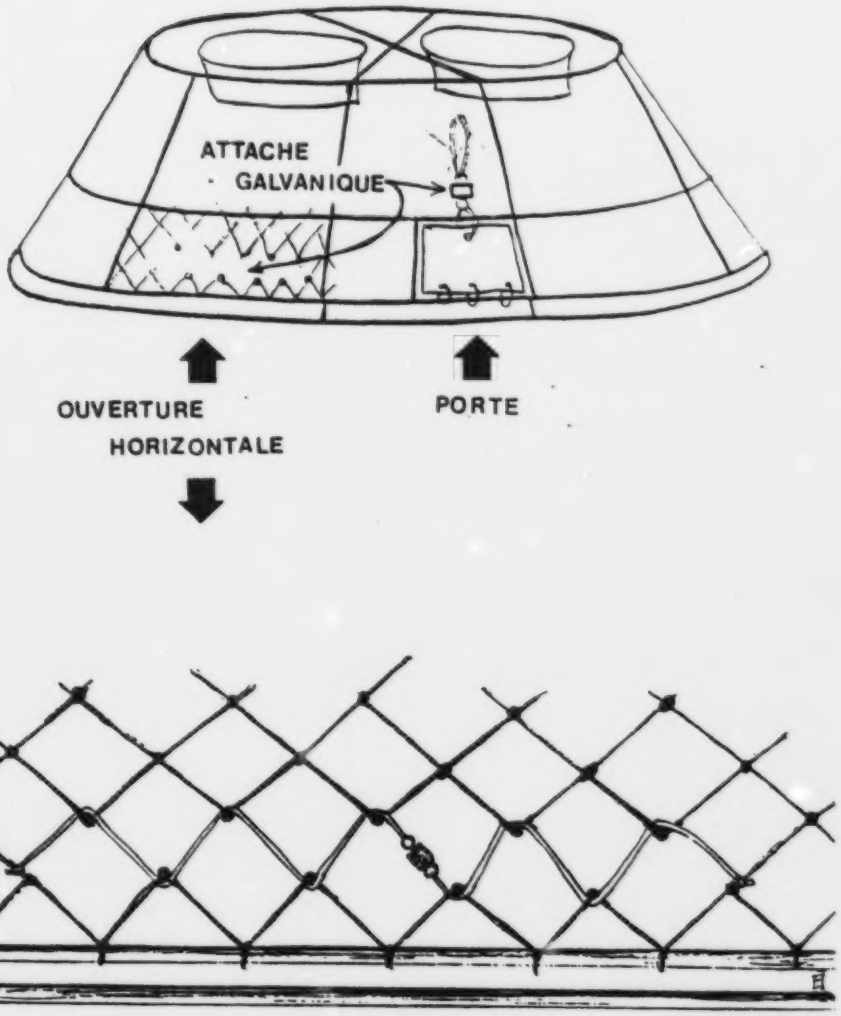
0,85 X

Fig. 1. Change in size of the galvanic attachments with increasing corrosion. Attachments prior to immersion in the sea are shown at the top of the figure.

GALVANIC ATTACHMENT

HORIZONTAL OPENING DOOR

Fig. 2. Schematic drawing of the two delayed release mechanisms installed on crab traps.

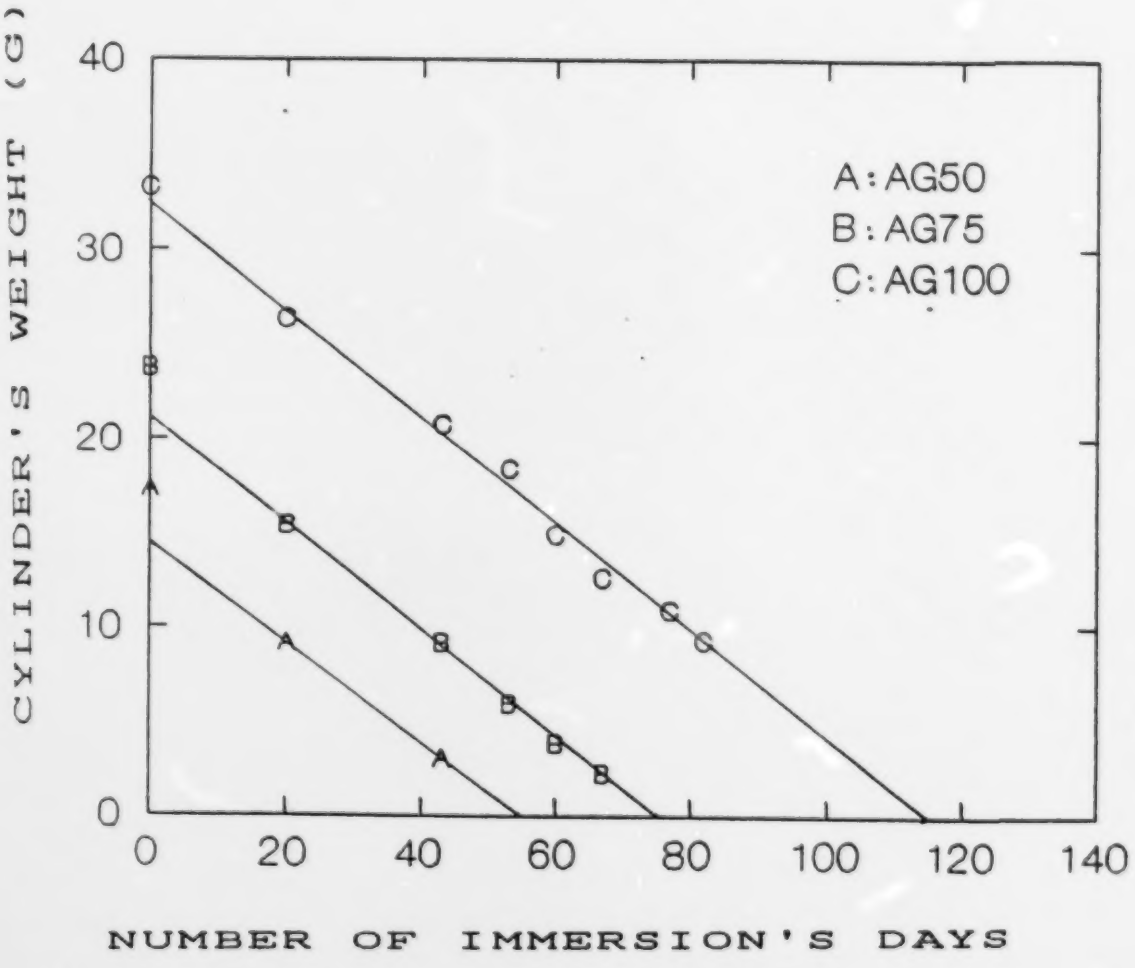


[vertical axis:] CYLINDER WEIGHT (g)

[horizontal axis:] NUMBER OF DAYS IMMERSION

[legend:] A: AG50
B: AG75
C: AG100

Fig. 3. Change in cylinder weight of the three calibers of galvanic device as a function of the number of days of immersion.

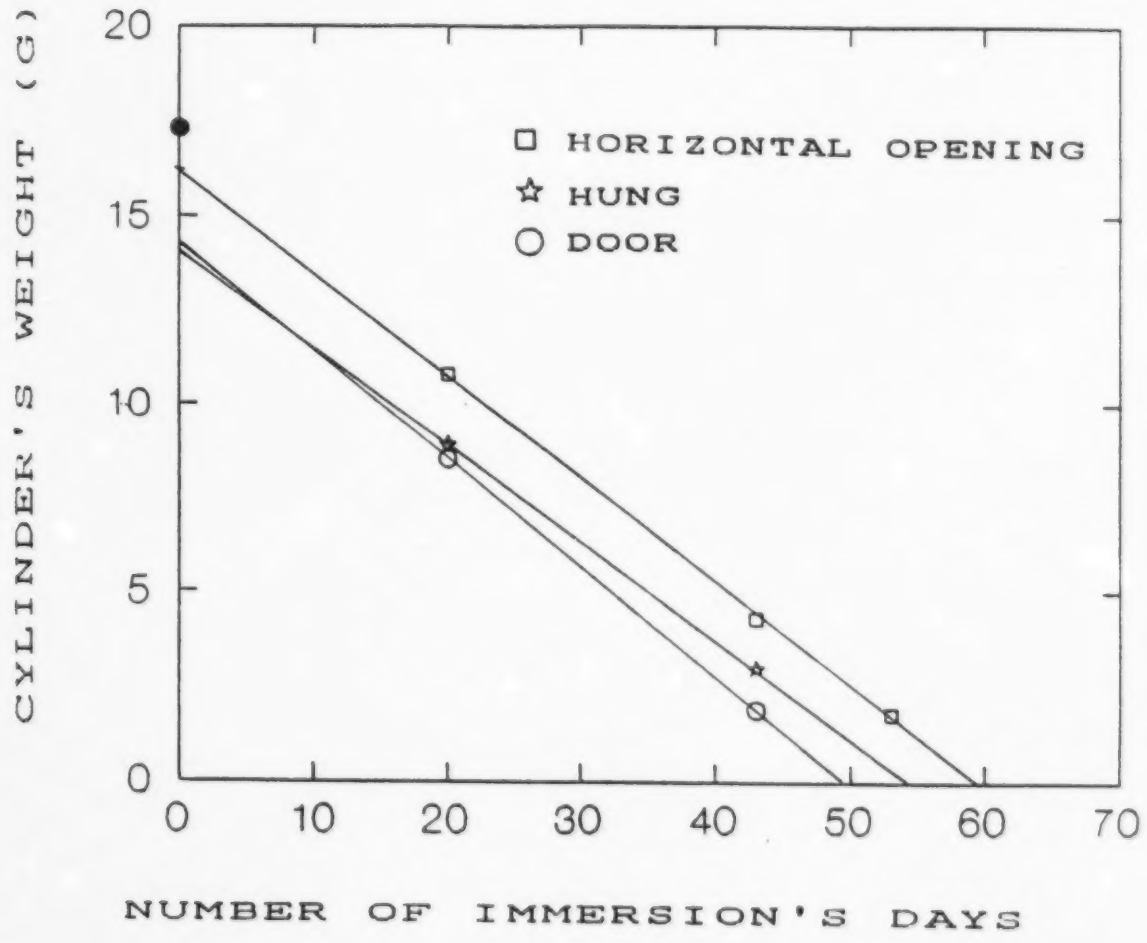


[vertical axis:] CYLINDER WEIGHT (g)

[horizontal axis:] NUMBER OF DAYS IMMERSION

[legend:] HORIZONTAL OPENING
HANGING
DOOR

Fig. 4. Change in cylinder weight of the AG50 attachment as a function of the number of days of immersion and the position on the trap.

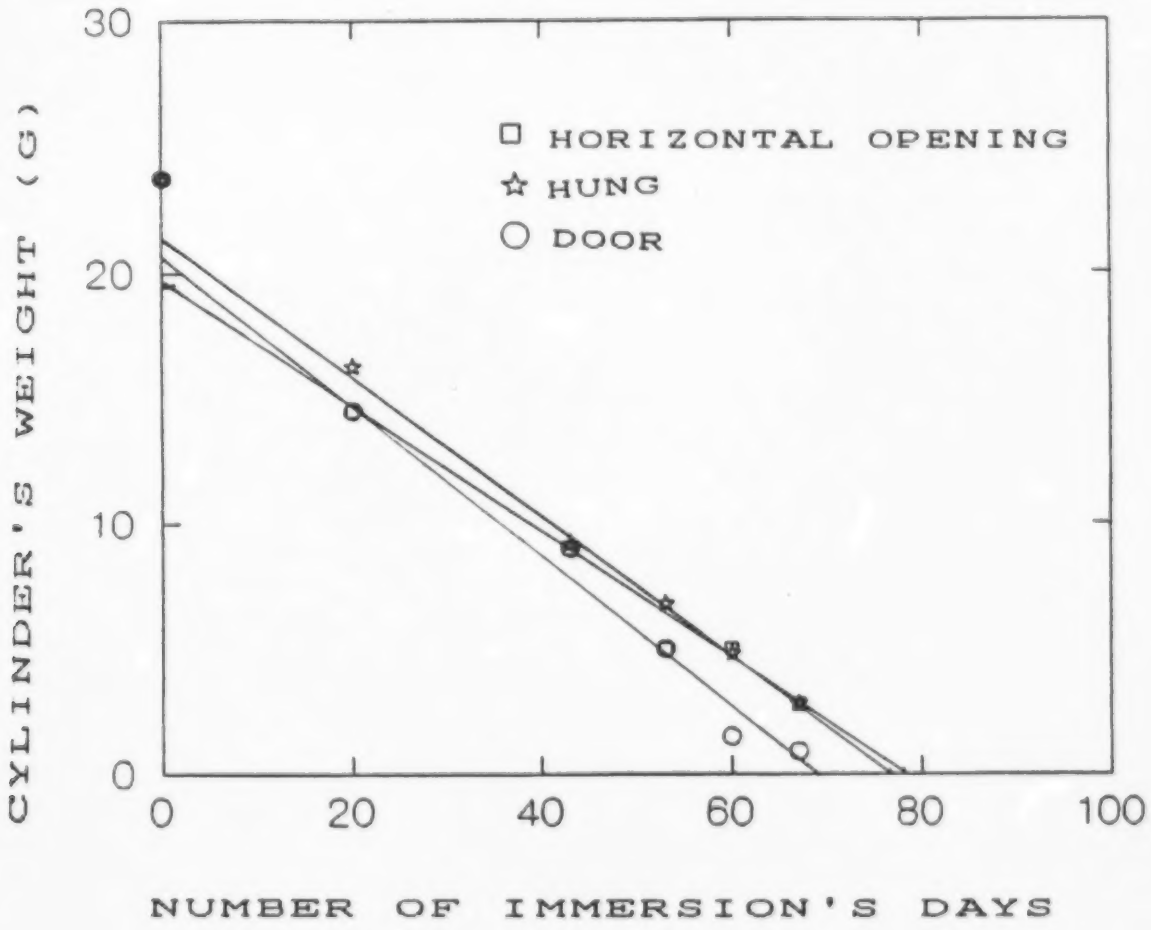


[vertical axis:] CYLINDER WEIGHT (g)

[horizontal axis:] NUMBER OF DAYS IMMERSION

[legend:] HORIZONTAL OPENING
HANGING
DOOR

Fig. 5. Change in cylinder weight of the AG75 attachment as a function of the number of days of immersion and the position on the trap.



[vertical axis:] CYLINDER WEIGHT (g)

[horizontal axis:] NUMBER OF DAYS IMMERSION

[legend:] HORIZONTAL OPENING
HANGING
DOOR

Fig. 6. Change in cylinder weight of the AG100 attachment as a function of the number of days of immersion and the position on the trap.